Bloomenergy™

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October 23, 2018

Mr. David Fees
Acting Division Director
Division of Air Quality
Delaware Department of Natural Resources and Environmental Control
State Street Commons
100 West Water Street
Suite 6A
Dover, Delaware 19904

Subject: **Diamond State Generation Partners, LLC**
Brookside Project – 2.6 MW Fuel Cells
Existing Permit: APC-2012/0052
Maintenance Upgrade Stationary Sources

Dear Mr. Fees:

Diamond State Generation Partners, LLC is proposing to perform a maintenance upgrade to the existing installation at the Brookside site with the most current generation of Bloom Energy servers and submits enclosed application. The upgraded Energy Servers will result in lowering all emissions including NO_x, CO, VOCs and CO_2.

The proposed maintenance upgrade will substitute 15 Bloom Energy 200kW ES-5700 servers totaling to 3MW and associated power electronics currently at the site with 13 Bloom Energy's current generation 200kW ES5-BABAAA servers totaling to 2.6MW. Two pads will remain empty after the upgrade. The following table highlights the reductions in overall emissions due to the upgrade.

	Existing ES-5700 Server lbs/MWh	New ES5 (200kW or 250kW) Server lbs/MWh	% Reduction
NOx	0.0021	0.0017	**19.0%**
CO	0.100	0.034	**66.0%**
VOC	0.020	0.016	**20.5%**
CO_2	773.0	700.0	**9.4%**

As part of the application we are attaching the following documents for your review and approval.

- Site Layout indicating which Bloom Energy servers are replaced

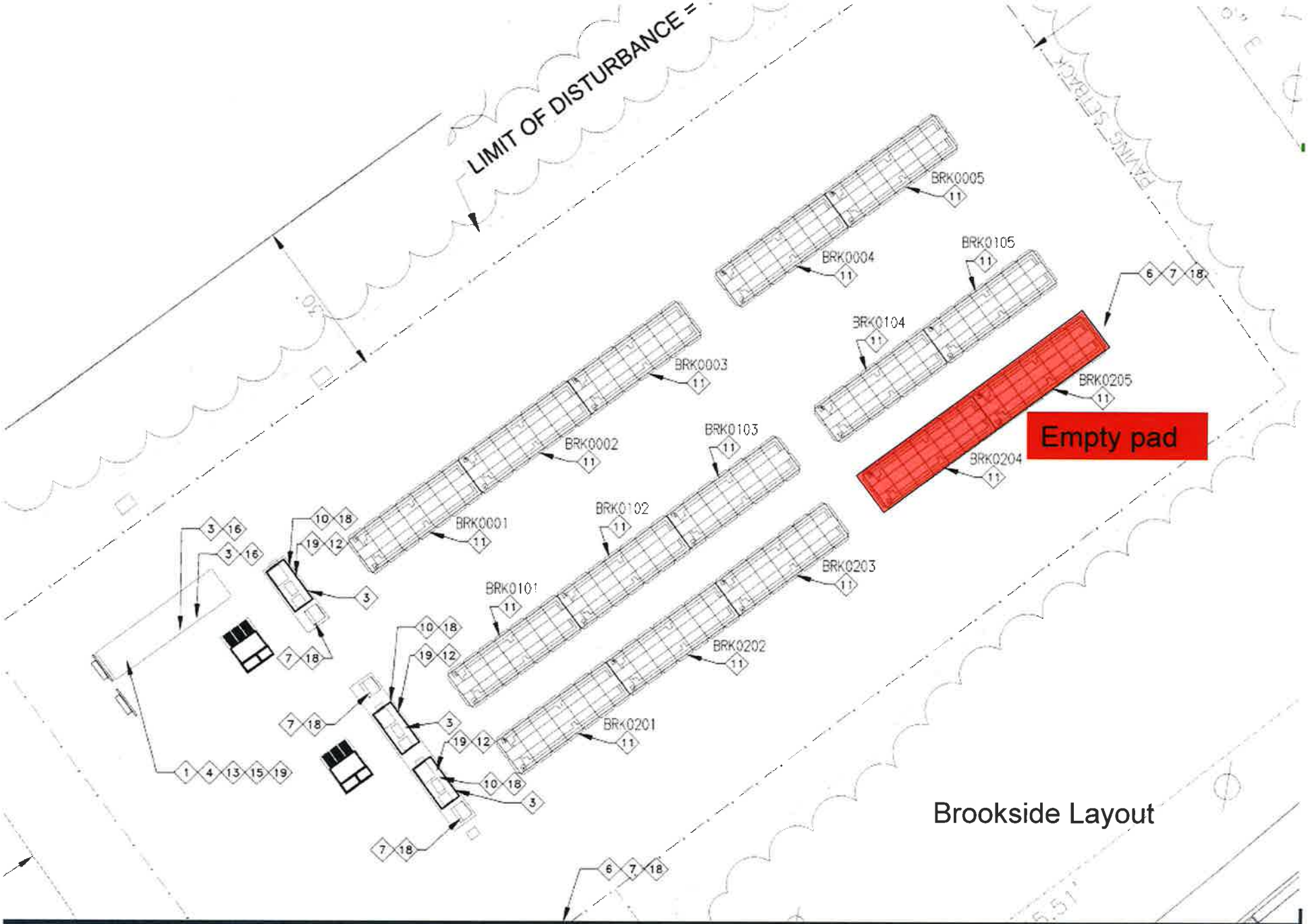
- ES5 – 200kW Datasheet
- CARB emission test results
- AQM-1; Administrative Information
- AQM-2; Process Flow Diagram
- AQM-3.1; Generic Process Equipment Application
- AQM-5; Emissions Information Application
- AQM-6; Air Emission Modeling Application
- 1hr CO and NOx AERSCREEN Modeling results

Thank you for your consideration. Please let me know if you have any questions.

Sincerely,

Mark Mesler
Vice President
Diamond State Generation Partners, LLC

Attachment I
Site Layout Drawing



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Attachment II
Bloom Energy ES5 200kW Fuel Cell Data Sheet

Bloomenergy®

Energy Server 5

Clean, Reliable, Affordable Energy

CLEAN, RELIABLE POWER ON DEMAND

Bloom Energy's Energy Server 5 delivers clean power that reduces emissions and energy costs. The modular architecture enables the installation to be tailored to the actual electricity demand, with a flexibility to add servers as the load increases. The Energy Server 5 actively communicates with Bloom Energy's network operations centers so system performance can be monitored and maintained 24 hours per day, 365 days per year.

INNOVATIVE TECHNOLOGY

Utilizing patented solid oxide fuel cell (SOFC) technology, the Energy Server 5 produces combustion-free power at unprecedented efficiencies, meaning it consumes less fuel and produces less CO_2 than competing technologies. Additionally, no water is needed under normal operating conditions.

ALL-ELECTRIC POWER

The Energy Server 5, which operates at a very high electrical efficiency, eliminates the need for complicated and costly CHP systems. Combining the standard electrical and fuel connections along with compact footprint and sleek design, the Energy Server 5 is the most deployable fuel cell on the market.

CONTROLLED AND PREDICTABLE COST

By providing efficient on-site power generation, the economic and environmental benefits are central to the Energy Server 5 value proposition. Bloom Energy customers can lock in their long term energy costs and mitigate the risk of electricity rate increases. The Energy Server 5 has been designed in compliance with a variety of safety standards and is backed by a comprehensive warranty.

About Bloom Energy

Bloom Energy is making clean, reliable energy affordable. Our unique on-site power generation systems utilize an innovative fuel cell technology with roots in NASA's Mars program. By leveraging breakthrough advances in materials science, Bloom Energy systems are among the most efficient energy generators, providing for significantly reduced operating costs and dramatically lower greenhouse gas emissions. Bloom Energy Servers are currently producing power for many Fortune 500 companies including Apple, Google, Walmart, AT&T, eBay, Staples, as well as notable non-profit organizations such as Caltech and Kaiser Permanente.

Headquarters:
Sunnyvale, California

For More Information:
www.bloomenergy.com

Energy Server 5

Technical Highlights (ES5-BABAAA)	
Outputs	
Nameplate power output (net AC)	210 kW
Base load output (net AC)	200 kW
Electrical connection	480 V, 3-phase, 60 Hz
Inputs	
Fuels	Natural gas, directed biogas
Input fuel pressure	10-18 psig (15 psig nominal)
Water	None during normal operation
Efficiency	
Cumulative electrical efficiency (LHV net AC)*	65-53%
Heat rate (HHV)	5,811-7,127 Btu/kWh
Emissions	
NOx	< 0.01 lbs/MWh
SOx	Negligible
CO	< 0.05 lbs/MWh
VOCs	< 0.02 lbs/MWh
CO_2 @ stated efficiency	679-833 lbs/MWh on natural gas; carbon neutral on directed biogas
Physical Attributes and Environment	
Weight	12.6 tons
Dimensions (variable layouts)	14' 9" x 8' 8" x 7' 0" or 25' 9" x 4' 5" x 7' 5"
Temperature range	-20° to 45° C
Humidity	0% - 100%
Seismic vibration	IBC site class D
Location	Outdoor
Noise	< 70 dBA @ 6 feet
Codes and Standards	
Complies with Rule 21 interconnection and IEEE1547 standards	
Exempt from CA Air District permitting; meets stringent CARB 2007 emissions standards	
An Energy Server is a Stationary Fuel Cell Power System. It is Listed by Underwriters Laboratories, Inc. (UL) as a 'Stationary Fuel Cell Power System' to ANSI/CSA FC1-2014 under UL Category IRGZ and UL File Number MH45102.	
Additional Notes	
Access to a secure website to monitor system performance & environmental benefits	
Remotely managed and monitored by Bloom Energy	
Capable of emergency stop based on input from the site	

* 65% LHV efficiency verified by ASME PTC 50 Fuel Cell Power Systems Performance Test

Bloomenergy®

Bloom Energy Corporation
1299 Orleans Drive
Sunnyvale CA 94089
T 408 543 1500
www.bloomenergy.com

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Attachment III
CARB Test Results

TABLE 6-1
EMISSION TEST RESULTS
BLOOM ENERGY
SYSTEM 5.0 POWER MODULE

Parameter	Run 1	Run 2	Run 3	Averages
Date:	11/5/14	11/5/14	11/5/14	--
Time:	0038-0138	0149-0249	0259-0359	--
Process Data:				
Cell Power Output, kW	60.39	60.24	60.37	60.33
Flue Gas:				
O_2, % volume dry	15.95	15.97	15.99	15.97
CO_2, % volume dry	2.810	2.812	2.806	2.809
Moisture Content, % volume	7.90	7.90	7.90	7.90
Stack Gas Velocity, dscfm	125.8	120.6	125.8	124.0
CO Emissions:				
ppmvd	3.90	3.83	3.77	3.83
lb/hr	0.0021	0.0020	0.0021	0.0021
lb/MW-hr	0.035	0.033	0.034	0.034
NO_X Emissions:				
ppmvd	0.129	*0.113*	*0.113*	*0.118*
lb/hr as NO_2	1.16E-04	*9.72E-05*	*1.01E-04*	*1.05E-04*
lb/MW-hr as NO_2	0.0019	*0.0016*	*0.0017*	*0.0017*
VOC Emissions:				
ppmvd as C	1.45	7.60	1.50	3.52
lb/hr as C_6H_{14}	0.0004	0.0020	0.0004	0.0010
lb/MW-hr as C_6H_{14}	0.0067	0.0339	0.0070	0.0159

Note: Results noted in italics were reported at the detection limit of the analyzer, 2% of the range.

Attachment IV
AQM-1; Administrative Information

DNREC – Division of Air Quality
Application to Construct, Operate, or Modify Stationary Sources

Administrative Information

One original and one copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 West Water Street, Suite 6A
Dover, DE 19904

All Checks Should Be Made Payable To:
State of Delaware

Company and Site Information

1.	Company Name: **Diamond State Generation Partners, LLC**		
2.	Company Mailing Address: **1299 Orleans Drive**		
	City: **Sunnyvale**	State: **CA**	Zip Code: **95014**
3.	Site Name: **Brookside**		
4.	Site Mailing Address: *(if different from above)*		
	City:	State:	Zip Code:
5.	Physical Location of Site: **512 E Chestnut Hill Rd** *(if different from above)*		
	City: **Newark**	State: **DE**	Zip Code: **19713**
6.	Site Billing Address: *(if different from above)*		
	City:	State:	Zip Code:
7.	Air Quality Management Facility ID Number:		
8.	Site NAICS Code): **22119** *(list all that apply*		
9.	Site SIC Code: **4991** *(list all that apply)*		
10.	Site Location Coordinates:	Latitude: 39.6681 ° deg' N" Longitude: 75.7151 ° deg' W"	
11.	Is the Facility New or Existing?	☐ NEW	☒ EXISTING
If the Facility is an Existing Facility, Complete the Rest of Question 11. If Not, Proceed to Question 12.			
11.1.	Does the Facility Have Active Air Permits?	☒ YES	☐ NO
12.	Is this Application For New Equipment or a Modification to Existing Equipment? ☐ New Equipment ☒ Modification of Existing Equipment ☐ Other (Specify):		
If the application is for the modification of existing equipment, complete the rest of Question 12. If not, proceed to Question 13.			

Company and Site Information

12.1. Does the Equipment Have an Active Air Permit? ☒ YES ☐ NO

If the equipment has an active air permit, complete the rest of Question 12. If not, proceed to Question 13.

12.2. Permit Number of Existing Equipment: **APC-2012/0052**

13. Status of Equipment Being Applied For:
☒ Natural Minor Source
☐ Synthetic Minor Source
☐ Major Source
☐ Federally Enforceable Restrictions

14. Facility Status: ☐ Natural Minor Facility ☐ Synthetic Minor Facility ☐ Major Facility

If the facility is a Major Source, complete the rest of Question 14. If not, proceed to Question 15.

14.1. Responsible Official Name:

14.2. Responsible Official Title:

Contact Information

15. Name of Owner or Facility Manager: **Diamond State Generation Partners, LLC**

16. Title of Owner or Facility Manager: **N/A**

17. Permit Contact Name: **Mark Mesler**

18. Permit Contact Title: **Vice President**

19. Permit Contact Telephone Number: **(408) 543-1743**

20. Permit Contact Fax Number: **(408) 543-1501**

21. Permit Contact E-Mail Address: **mark.mesler@bloomenergy.com**

22. Billing Contact Name: **Mark Mesler**

23. Billing Contact Title: **Vice President**

24. Billing Contact Telephone Number: **(408) 543-1743**

25. Billing Contact Fax Number: **(408) 543-1501**

26. Billing Contact E-Mail Address: **mark.mesler@bloomenergy.com**

Proposed Construction and Operating Schedule

27. When Will the Proposed Construction/Installation/Modification Occur: Target Start: 12/15/2018

28. Proposed Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

28.1. Is There Any Additional Information Regarding the Operating Schedule? ☐ YES ☒ NO

If YES, complete the rest of Question 28. If NO, proceed to Question 29.

Proposed Construction and Operating Schedule

28.2. Describe the Additional Information:

Coastal Zone Information

29. Is the Facility Located in the Coastal Zone? ☐ YES ☒ NO

If the facility is located in the Coastal Zone complete the rest of Question 29. If not, proceed to Question 30.

29.1. Is a Coastal Zone Permit Required for Construction or Operation of the Source Being Applied for? ☐ YES ☒ NO

Attach a copy of the Coastal Zone Determination if it has not been previously submitted

If a Coastal Zone Permit is required complete the rest of Question 29. If not, proceed to Question 30.

29.2. Has a Coastal Zone Permit Been Issued? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Permit if it has not been previously submitted

Local Zoning Information

30. Parcel Zoning: **S**

Attach Proof of Local Zoning if it has not been previously submitted

Application Information

31. Is the Appropriate Application Fee Attached? ☒ YES ☐ NO

32. Is the Advertising Fee Attached? ☒ YES ☐ NO

For help determining your application and advertising fees see:
http://www.dnrec.state.de.us/DNREC2000/Library/Fees/DE%20Permit%20Fees.htm

Attach the appropriate fees. Note that your Application will not be considered complete if the appropriate fees are not included.

33. Is a Cover Letter Describing the Process Attached? ☒ YES ☐ NO

Attach a brief cover letter describing your Application.

If the Facility is a New Facility complete Question 34. If not, proceed to Question35.

34. Is a Copy of the Applicant Background Information Questionnaire on Record at the Department? ☒ YES ☐ NO

If NO, complete the rest of Question 34. If YES, process to Question 35.

34.1 Is a Copy of the Applicant Background Information Questionnaire Attached? ☐ YES ☐ NO

For a copy of the Applicant Background Information Questionnaire see
http://www.dnrec.delaware.gov/services/Documents/Chapter79Form.pdf

Attach a copy of the Applicant Background Information Questionnaire if applicable.

35. Check Which Application Forms are Attached:

Application Information

☒ AQM-1	☐ AQM-3.4	☐ AQM-3.9	☐ AQM-3.14	☐ AQM-4.4	☐ AQM-4.9	☒ AQM-6
☒ AQM-2	☐ AQM-3.5	☐ AQM-3.10	☐ AQM-3.15	☐ AQM-4.5	☐ AQM-4.10	
☒ AQM-3.1	☐ AQM-3.6	☐ AQM-3.11	☐ AQM-4.1	☐ AQM-4.6	☐ AQM-4.11	
☐ AQM-3.2	☐ AQM-3.7	☐ AQM-3.12	☐ AQM-4.2	☐ AQM-4.7	☐ AQM-4.12	
☐ AQM-3.3	☐ AQM-3.8	☐ AQM-3.13	☐ AQM-4.3	☐ AQM-4.8	☒ AQM-5	

36. Check Which Documents are Attached:

- ☐ Coastal Zone Determination
- ☐ Coastal Zone Permit
- ☐ Proof of Local Zoning
- ☐ Application Fee
- ☐ Advertising Fee
- ☐ Applicant Background Information Questionnaire
- ☐ Claim of Confidentiality
- ☐ Manufacturer Specification(s)
- ☐ Material Safety Data Sheets (MSDSs)
- ☐ Supporting Calculations
- ☐ Descriptive Cover Letter
- ☐ Other (Specify):

Confidentiality Information

37. Do You Consider Any of the Information Submitted With this Application Confidential? ☐ YES ☒ NO

For help on how to submit a confidentiality claim see
http://regulations.delaware.gov/register/december2011/final/15%20DE%20Reg%20864%2012-01-11.htm

If a Claim of Confidentiality is made it MUST meet the requirements of Section 6 of DNREC's Freedom of Information ("FOIA") Regulation at the time the Application is submitted.

Signature Block

I, the undersigned, hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all of its attachments as to the truth, accuracy, and completeness of this information. I certify based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete. By signing this form, I certify that I have not changed, altered, or deleted any portions of this application. I acknowledge that I cannot commence construction, alteration, modification or initiate operation until I receive written approval (i.e. permit, registration, or exemption letter) from the Department. I acknowledge that I may be required to perform testing of the equipment to receive construction or operation approval, and that if I do not receive approval to construct or operate that I may appeal the decision.

MARK MESLER
Owner or Operator

10/23/18
Date

Mark Mesler
Signature of Owner or Operator

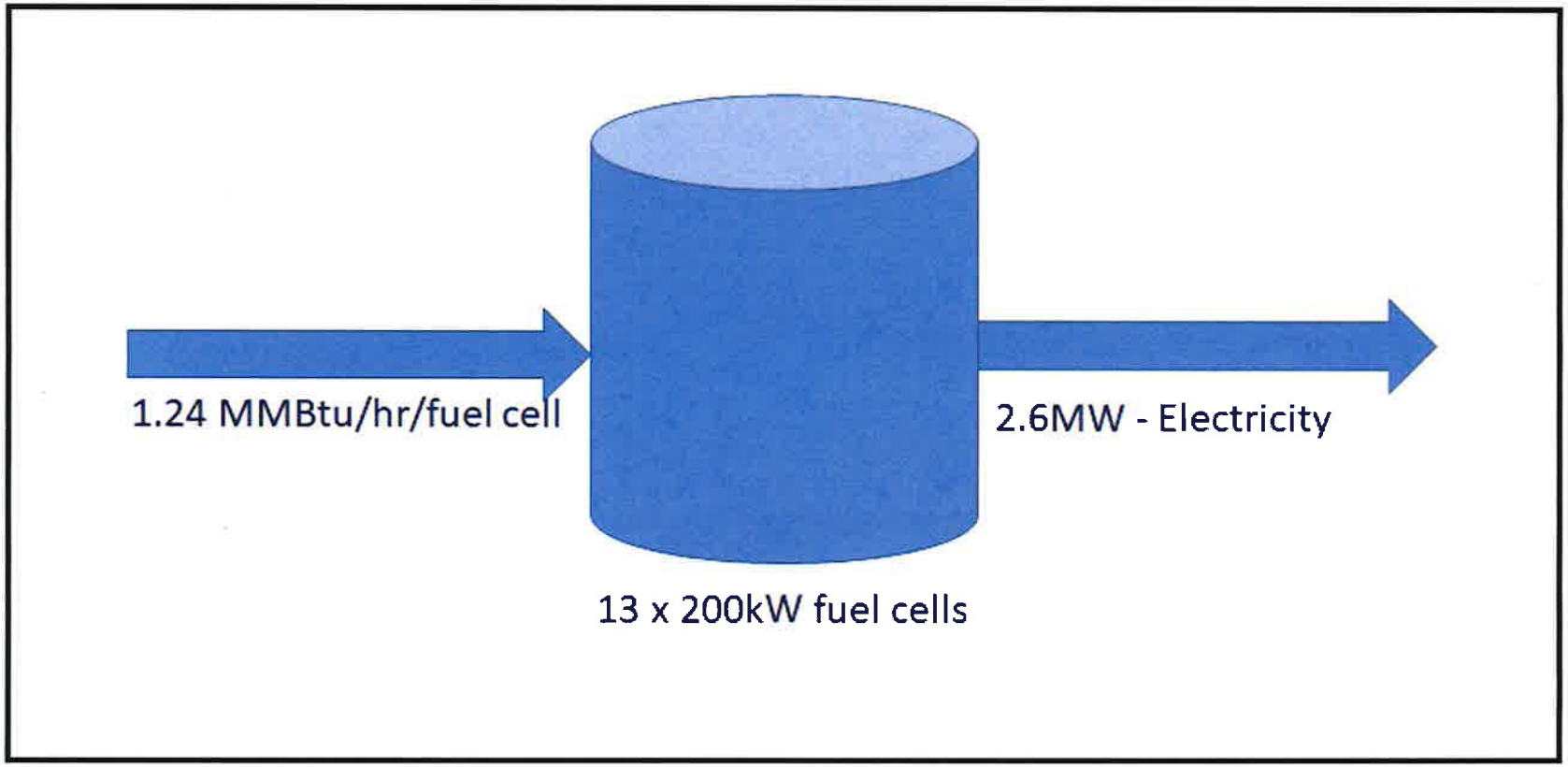
One Original and One Copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 W. Water Street, Suite 6A
Dover, Delaware 19904

All Checks Should Be Made Payable To:
State of Delaware

Attachment V
AQM-2; Process Flow Diagram

Process Flow Diagram

Sketch the Process Flow Diagram for the equipment or process being applied for. Include each emission unit and control device (even existing emission units that will not be modified by this application). You may identify each emission unit with a simple shape. Label each emission unit and control device with a unique identifier. Show the relationship between each emission unit and/or control device by drawing arrows between them to indicate the flow of air pollutants. List which application forms are included for each emission unit or control device below the shape representing each emission unit or control device . See http://www.delaware.gov/reg2/default.htm for example Process Flow Diagrams for common processes. If you already have a Process Flow Diagram for the equipment or process being applied for, you may attach it to the application instead of using this form.



Attachment VI
AQM-3.1; Generic Process Equipment Application

Generic Process Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information

1.	Facility Name: **Brookside**
2.	Equipment ID Number: **E1 through E13**
3.	Provide a brief description of Equipment or Process: **The project consists of 13 fuel cells rated at 200kW using natural gas to generate a total of 2.6MW**
4.	Manufacturer: **Bloom Energy**
5.	Model: **ES5-BABAAA (200kW)**
6.	Serial Number: **N/A**

Raw Material Information

7. Raw Materials Used in Process

If there are more than four Raw Materials used, attach additional copies of this page as needed.

	Raw Material Used	CAS Number	Usage Rate (include units)	MSDS Attached?
7.1.	**Natural Gas**	**N/A**	**137 MMscf/yr**	☐ YES ☒ NO
7.2.				☐ YES ☐ NO
7.3.				☐ YES ☐ NO
7.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Raw Material used.

Products Produced Information

8. Products Produced

If there are more than four Products Produced, attach additional copies of this page as needed.

	Product Produced	CAS Number	Production Rate (include units)	MSDS Attached?
8.1.	**Electricity**	**N/A**	**2.6 MW**	☐ YES ☒ NO
8.2.				☐ YES ☐ NO
8.3.				☐ YES ☐ NO
8.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Product Produced.

Byproducts Generated Information

9. Byproducts Generated

If there are more than four Byproducts Generated, attach additional copies of this page as needed.

	Byproduct Generated	CAS Number	Generation Rate (include units)	MSDS Attached?
9.1.				☐ YES ☐ NO
9.2.				☐ YES ☐ NO
9.3.				☐ YES ☐ NO
9.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Byproduct Generated.

General Information

10. Manufacturer's Rated Capacity or Maximum Throughput of Equipment or Process: **200kW per fuel cell, maximum of 1.24MMBtu/hr of natural gas per fuel cell**

11. Describe Important Manufacturer Specifications and/or Operating Parameters for Equipment or Process:

Attach the Manufacturer's Specification Sheet(s) for the equipment or process.

Control Device Information

12. Is an Air Pollution Control Device Used? ☐ YES ☒ NO

If an Air Pollution Control Device is used, complete the rest of Question 12. If not, proceed to Question 13.

12.1. Is Knockout Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.11 and attach it to this application.

12.2. Is a Settling Chamber Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.10 and attach it to this application.

12.3. Is an Inertial or Cyclone Collector Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.5 and attach it to this application.

12.4. Is a Fabric Collector or Baghouse Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.6 and attach it to this application.

12.5. Is a Venturi Scrubber Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.8 and attach it to this application.

12.6. Is an Electrostatic Precipitator Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.7 and attach it to this application.

12.7. Is Adsorption Equipment Used? ☐ YES ☒ NO

Control Device Information

If YES, complete Form AQM-4.2 and attach it to this application.

12.8. Is a Scrubber Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.4 and attach it to this application.

12.9. Is a Thermal Oxidizer or Afterburner Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.1 and attach it to this application.

12.10. Is a Flare Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.3 and attach it to this application.

12.11. Is Any Other Control Device Used? ☐ YES ☒ NO

If YES, attach a copy of the control device Manufacturer's Specification Sheet(s).

If any other control device is used, complete the rest of Question 12. If not, proceed to Question 13.

12.12. Describe Control Device: **N/A**

12.13. Pollutants Controlled: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_x ☐ SO_x ☐ Metals ☐ Other (Specify):

12.14. Control Device Manufacturer: **N/A**

12.15. Control Device Model: **N/A**

12.16. Control Device Serial Number: **N/A**

12.17. Control Device Design Capacity: **N/A**

12.18. Control Device Removal or Destruction Efficiency: **N/A**

Stack Information

13. How Does the Process Equipment Vent:
(check all that apply)
☒ Directly to the Atmosphere
☐ Through a Control Device Covered by Forms AQM-4.1 through 4.12
☐ Through Another Control Device Described on This Form

If any of the process equipment vents directly to the atmosphere or through another control device described on this form, proceed to Question 14. If the process equipment vents through a control device, provide the stack parameters on the control device form and proceed to Question 18.

14. Number of Air Contaminant Emission Points: **13 fuel cells**

If there are more than three Emission Points, attach additional copies of this page as needed.

For the first Emission Point

15. Emission Point Name: **FC1 through FC13**

15.1. Stack Height Above Grade: **6.75 feet**

15.2. Stack Exit Diameter: **0.39 x 2.68 x 4 Power modules feet**
(Provide Stack Dimensions If Rectangular Stack)

15.3. Is a Stack Cap Present? ☐ YES ☒ NO

15.4. Stack Configuration: ☒ Vertical ☐ Horizontal ☐ Downward-Venting
(check all that apply) ☐ Other (Specify):

Stack Information
15.5. Stack Exit Gas Temperature: **204 °F**
15.6. Stack Exit Gas Flow Rate: **440 x 4 Power modules ACFM**
15.7. Distance to Nearest Property Line: **53 feet**
15.8. Describe Nearest Obstruction:
15.9. Height of Nearest Obstruction: **feet**
15.10. Distance to Nearest Obstruction: **feet**
15.11. Are Stack Sampling Ports Provided? ☐ YES ☒ NO
For the second Emission Point. If there is no second Emission Point, proceed to Question 18.
16. Emission Point Name:
16.1. Stack Height Above Grade: **feet**
16.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
16.3. Is a Stack Cap Present? ☐ YES ☒ NO
16.4. Stack Configuration: *(check all that apply)* ☐ Vertical ☐ Horizontal ☐ Downward-Venting ☐ Other (Specify):
16.5. Stack Exit Gas Temperature: **°F**
16.6. Stack Exit Gas Flow Rate: **ACFM**
16.7. Distance to Nearest Property Line: **feet**
16.8. Describe Nearest Obstruction:
16.9. Height of Nearest Obstruction: **feet**
16.10. Distance to Nearest Obstruction: **feet**
16.11. Are Stack Sampling Ports Provided? ☐ YES ☒ NO
For the third Emission Point. If there is no third Emission Point, proceed to Question 18.
17. Emission Point Name:
17.1. Stack Height Above Grade: **feet**
17.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
17.3. Is a Stack Cap Present? ☐ YES ☐ NO
17.4. Stack Configuration: *(check all that apply)* ☐ Vertical ☐ Horizontal ☐ Downward-Venting ☐ Other (Specify):
17.5. Stack Exit Gas Temperature: **°F**
17.6. Stack Exit Gas Flow Rate: **ACFM**
17.7. Distance to Nearest Property Line: **feet**
17.8. Describe Nearest Obstruction:
17.9. Height of Nearest Obstruction: **feet**
17.10. Distance to Nearest Obstruction: **feet**

Stack Information

17.11. Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring Information

18. Will Emissions Data be Recorded by a Continuous Emission Monitoring System? ☐ YES ☒ NO

If Yes, attach a copy of the Continuous Emission Monitoring System Manufacturer's Specification Sheets

If YES, complete the rest of Question 18. If NO, proceed to Question 19.

18.1. Pollutants Monitored: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_x ☐ SO_x ☐ Metals ☐ Other (Specify):

18.2. Describe the Continuous Emission Monitoring System:

18.3. Manufacturer:

18.4. Model:

18.5. Serial Number:

18.6. Will Multiple Emission Units Be Monitored at the Same Point? ☐ YES ☐ NO

If YES, complete the rest of Question 18. If NO, proceed to Question 19.

18.7. Emission Units Monitored:

18.8. Will More Than One Emission Unit be Emitting From the Combined Point At Any Time? ☐ YES ☐ NO

If YES, complete the rest of Question 18. If NO, proceed to Question 19.

18.9. Emission Units Emitting Simultaneously:

Voluntary Emission Limitation Request Information

19. Are You Requesting Any Voluntary Emission Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.? ☐ YES ☒ NO

If YES, complete the rest of Question 19. If NO, proceed to Question 20.

19.1. Describe Any Requested Emission Limitations:

Voluntary Operating Limitation Request Information

20. Are You Requesting Any Voluntary Operating Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.? ☐ YES ☒ NO

If YES, complete the rest of Question 20. If NO, proceed to Question 21.

Voluntary Operating Limitation Request Information
20.1. Describe Any Requested Operating Limitations:

Additional Information	
21. Is There Any Additional Information Pertinent to this Application?	☒ YES ☐ NO
If YES, complete the rest of Question 21.	
21.1. Describe: **See Air Permit Application**	

Attachment VII
AQM-5; Emissions Information Application

Emissions Information Application

If you are using this form electronically, press F1 at any time for help

Process Information	
1.	Number of Individual Pieces of Process Equipment in Process: **13**
2.	Number of Individual Control Devices in Process: **0**

Emissions Information for First Emission Point/Stack

3. Emission Point Name: **1-13 Emission Data for each individual fuel cell (200kW)**

4. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **1-13 (200kW)**

5. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 5.10 through 5.18)	CAS Number (Not required for 5.1 through 5.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
5.1.	Particulate Matter (PM)		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	**0** tons/year
5.2.	PM_{10}		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	**0** tons/year
5.3.	$PM_{2.5}$		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	**0** tons/year
5.4.	Sulfur Oxides (SO_X)		**0.000020 lbs/hour**	**0.000020 lbs/hour**	**0.00009** tons/year	tons/year
5.5.	Nitrogen Oxides (NO_X)		**0.00034 lbs/hour**	**0.00034 lbs/hour**	**0.0015** tons/year	tons/year
5.6.	Carbon Monoxide (CO)		**0.007 lbs/hour**	**0.007 lbs/hour**	**0.0298** tons/year	tons/year
5.7.	Total Volatile Organic Compounds (VOCs)		**0.0032 lbs/hour**	**0.0032 lbs/hour**	**0.0139** tons/year	tons/year
5.8.	Total Hazardous Air		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	tons/year

Emissions Information for First Emission Point/Stack

	Pollutants (HAPs)					
5.9.	CO_2		**140 lbs/hour**	**140 lbs/hour**	**613.20** tons/year	tons/year
5.10.	CO_{2e}		**140 lbs/hour**	**140 lbs/hour**	**556.6 MT/year** tons/year	tons/year
5.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

6. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Second Emission Point/Stack

7. Emission Point Name:

8. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

9. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 9.10 through 9.18)	CAS Number (Not required for 9.1 through 9.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
9.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Second Emission Point/Stack

9.3.	$PM_{2.5}$		lbs/hour	lbs/hour	tons/year	tons/year
9.4.	Sulfur Oxides (SO_X)		lbs/hour	lbs/hour	tons/year	tons/year
9.5.	Nitrogen Oxides (NO_X)		lbs/hour	lbs/hour	tons/year	tons/year
9.6.	Carbon Monoxide (CO)		lbs/hour	lbs/hour	tons/year	tons/year
9.7.	Total Volatile Organic Compounds (VOCs)		lbs/hour	lbs/hour	tons/year	tons/year
9.8.	Total Hazardous Air Pollutants (HAPs)		lbs/hour	lbs/hour	tons/year	tons/year
9.9.	CO_2		lbs/hour	lbs/hour	tons/year	tons/year
9.10.	CO_{2e}		lbs/hour	lbs/hour	tons/year	tons/year
9.11.			lbs/hour	lbs/hour	tons/year	tons/year
9.12.			lbs/hour	lbs/hour	tons/year	tons/year
9.13.			lbs/hour	lbs/hour	tons/year	tons/year
9.14.			lbs/hour	lbs/hour	tons/year	tons/year
9.15.			lbs/hour	lbs/hour	tons/year	tons/year

10. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Third Emission Point/Stack

11.	Emission Point Name:
12.	Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:
13.	Pollutant Emissions

Emissions Information for Third Emission Point/Stack

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 13.10 through 13.18)	CAS Number (Not required for 13.1 through 13.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
13.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.4.	Sulfur Oxides (SO_x)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.5.	Nitrogen Oxides (NO_x)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

14. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Emissions Information for Third Emission Point/Stack

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Fourth Emission Point/Stack

15. Emission Point Name:

16. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

17. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 17.10 through 17.18)	CAS Number (Not required for 17.1 through 17.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
17.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.4.	Sulfur Oxides (SO_x)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.5.	Nitrogen Oxides (NO_x)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.7.	Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Fourth Emission Point/Stack					
17.13.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.14.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.15.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
18. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:					
Attach the Basis of Determination or Calculations for each Emission Rate provided above.					
If there are more than four Emission Points/Stacks, attach additional copies of this form as needed.					

Overall Process Emissions

19. Pollutant Emissions

If more than 15 pollutants are emitted from this Process, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 19.10 through 19.18)	CAS Number (Not required for 19.1 through 19.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
19.1.	Particulate Matter (PM)		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	tons/year
19.2.	PM_{10}		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	tons/year
19.3.	$PM_{2.5}$		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	tons/year
19.4.	Sulfur Oxides (SO_X)		**0.0003 lbs/hour**	**0.0003 lbs/hour**	**0.0012** tons/year	tons/year
19.5.	Nitrogen Oxides (NO_X)		**0.0044 lbs/hour**	**0.0044 lbs/hour**	**0.019** tons/year	tons/year
19.6.	Carbon Monoxide (CO)		**0.0884 lbs/hour**	**0.0884 lbs/hour**	**0.387** tons/year	tons/year
19.7.	Total Volatile Organic Compounds (VOCs)		**0.0413 lbs/hour**	**0.0413 lbs/hour**	**0.181** tons/year	tons/year
19.8.	Total Hazardous Air Pollutants (HAPs)		**0 lbs/hour**	**0 lbs/hour**	**0** tons/year	tons/year

Overall Process Emissions

19.9. CO_2		**1820 lbs/hour**	**1820 lbs/hour**	**7972** tons/year	tons/year
19.10. CO_{2e}		**1821 lbs/hour**	**1821 lbs/hour**	**7235 MT/year** tons/year	tons/year
19.12.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.13.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.14.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.15.		**lbs/hour**	**lbs/hour**	tons/year	tons/year

20. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Minor New Source Review Information

21. Does the Process Have the Potential to Emit More Than Five Tons Per Year of Any Pollutant? ☒ YES ☐ NO

22. Is the Source New or Existing? **See Question 11 of AQM-1** ☐ NEW ☒ EXISTING

If the Process has the Potential to Emit more than five tons per year of any pollutant, and is a New Source, a Control Technology Analysis pursuant to Regulation No. 1125 Section 4 must be conducted and attached to this application.

Major New Source Review Information

23. Does the Process Have the Potential to Emit More Than the Significance Level for Any Pollutant? *(Check All That Apply)*

- ☐ Greater Than 25 Tons Per Year of Particulate Matter (PM)
- ☐ Greater Than 15 Tons Per Year of PM_{10}
- ☐ Greater Than 10 Tons Per Year of $PM_{2.5}$
- ☐ Greater Than 40 Tons Per Year of Sulfur Dioxide(SO_2)
- ☐ Greater Than 25 Tons Per Year of Nitrogen Oxides (NO_X) in New Castle and Kent County
- ☐ Greater Than 100 Tons Per Year of Nitrogen Oxides (NO_X) in Sussex County
- ☐ Greater Than 100 Tons Per Year of Carbon Monoxide (CO)
- ☐ Greater Than 25 Tons Per Year of Total Volatile Organic Compounds (VOCs) in New Castle and Kent County
- ☐ Greater Than 50 Tons Per Year of Total Volatile Organic Compounds (VOCs) in Sussex County
- ☐ Greater Than 75,000 Tons Per Year of Equivalent Carbon Dioxide (CO_{2e})

If the Process has the Potential to Emit greater than any of the amounts listed above 7 DE Admin. Code 1125 Sections 2 and/or 3 apply. Contact the Department at (302) 323-4542 or (302) 739-9402 for additional information

Additional Information

24. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO

If YES, complete the rest of Question 24.

24.1. Describe: **See attached application**

Attachment VIII
AQM-6 Air Emission Modeling Application

Air Emissions Modeling Application

This form is optional. Applications will be considered complete without this form. Completing this form may expedite processing of your permit.

If you are using this form electronically, press F1 at any time for help. For additional help conducting air emissions modeling see the air contaminant equipment registration form booklet sections V and VI available at:
http://www.awm.delaware.gov/AQM/Pages/AirContaminantEquipmentRegistration.aspx.

General Information

1. Identification of Equipment/Process Being Modeled: **Brookside 13 Fuel Cells**

2. Modeling Tool Used: ☐ SCREEN3 ☒ AERSCREEN ☐ Other (Specify):
☐ ISC3 ☐ AERMOD

Modeling Information

3. Modeling Information

If there are more than 20 Contaminants, attach additional copies of this page as needed

	Contaminant Name	Maximum Controlled Emission Rate at Design Capacity	Short Term Emission Rate	Threshold Limit Value (TLV)	TLV Source	Maximum Downwind Concentration (MDC) (8-Hour Average)	TLV:MDC Ratio
3.1.	**NOx**	**0.1056** lbs/day	**0.00056** grams/second	mg/m^3		mg/m^3	
3.2.	**CO**	**2.12** lbs/day	**0.011** grams/second	mg/m^3		mg/m^3	
3.3.		lbs/day	grams/second	mg/m^3		mg/m^3	
3.4.		lbs/day	grams/second	mg/m^3		mg/m^3	
3.5.		lbs/day	grams/second	mg/m^3		mg/m^3	
3.6.		lbs/day	grams/second	mg/m^3		mg/m^3	
3.7.		lbs/day	grams/second	mg/m^3		mg/m^3	
3.8.		lbs/day	grams/second	mg/m^3		mg/m^3	
3.9.		lbs/day	grams/second	mg/m^3		mg/m^3	

Modeling Information

3.10.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.11.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.12.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.13.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.14.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.15.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.16.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.17.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.18.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.19.	lbs/day	grams/second	mg/m^3		mg/m^3	
3.20.	lbs/day	grams/second	mg/m^3		mg/m^3	

NOTE: If the TLV:MDC Ratio is less than 100 for any of the Contaminants listed above, the equipment may not be eligible for approval. Contact the Department immediately to discuss the situation.

Attach copies of all modeling analyses conducted.

Additional Information

4. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO

If YES, complete the rest of Question 4.

4.1. Describe: **1 hr CO and NOx AERSCREEN modeling**

Attachment IX
AERSCREEN Modeling Report

AERSCREEN MODELING REPORT
CO AND 1-HOUR NOx

BROOKSIDE UPGRADE PROJECT
23 – OCT - 2018

TABLE OF CONTENTS

1.0 Purpose of Study

This modeling study was performed at the request of the Delaware Department of Natural Resources and Environmental Control (DNREC) for the purpose of predicting the 1-hour/8-hour CO and 1-hour NO_2 impacts from Diamond State Generation Partners, LLC proposed upgrade of the existing Brookside Project. The Brookside Upgrade Project consists of removing 15 natural gas fueled ES-5700 Energy Servers with 13 latest generation ES5-BABAAA Energy servers, each with an output capacity of 200kW.

DNREC is seeking assurance that the CO and NOx emissions from this proposed facility can demonstrate compliance with the short-term CO and NO_2 National Ambient Air Quality Standards (NAAQS).

The following sections of this report provide the details for the AERSCREEN analysis used to determine compliance with the short-term CO and NO_2 standards. Section 2 provides a detailed description of the modeling methodology used for this study, Section 3 provides the results from this study documenting that AERSCREEN shows compliance with the short-term CO and NO_2 standards.

2.0 Modeling Methodology

The modeling performed for this study is a screening level analysis of 1-hour/8-hour CO and 1-hour NO_2 impacts, as requested by DNREC. This modeling was conducted following current USEPA modeling guidance. The following subsections 2.1 through 2.5 contain the detailed information regarding site characterization, meteorological and background monitored data, and model options used for this study. The majority of the assumptions from the original modeling work in 2012 have been retained.

On March 1, 2011 EPA released a clarification memo regarding various aspects of modeling for demonstration of compliance with the 1-hour NO_2 NAAQS.[1] Included within this memo is a discussion regarding the three-tier approach than can be employed for modeling of 1-hour NO_2, as well as a clarification on what is appropriate to use for the assumption of background NO_2 concentrations. In 2012, all NO_2 modeling for this analysis was performed in a manner consistent with this memo including use of the 3-year average of monitored annual 98th percentile daily 1-hour maximum NO_2 concentration as the background concentration for NAAQS comparison (see Section 2.4).

The tiered approach to modeling 1-hour NO_2 is a hierarchical structure, with Tier 1 the most conservative, while Tier 3 is the least conservative. The assumptions for each tier are as follows:

- Tier 1 – Model the facility assuming that all NOx emitted from a facility is emitted as NO_2.
- Tier 2 – Use a default ambient ratio of 0.80 for conversion of NOx to NO_2. This allows for a facility to subtract 20% from the total NOx impact predicted in Tier 1.
- Tier 3 – Use the AERSCREEN model, utilizing the PVMRM and/or OLM approaches.

For the upgrade project, Tier 1 was assumed, as this is the most conservative.

[1] *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*, USEPA-OAQPS memo, Tyler Fox, March 1, 2011.

Model Used

Short-range transport dispersion model predictions (within 10 km of the facility) are required for this analysis to determine project-alone impacts for comparison to the short-term CO and NO_2 NAAQS.

For the original project, the AERSCREEN model (Ver. 11126) was the EPA's "preferred/recommended" screening model for use in modeling analyses with plume transport distances of less than 50 km. In March 2011, the U.S. EPA released AERSCREEN, a screening model based on the AERMOD dispersion algorithms, which is expected generally to yield more realistic concentrations than the existing SCREEN3 model, while maintaining conservatism over more refined analyses. Use of AERSCREEN for the screening analysis of this Project conforms to both EPA and DNREC recommendations. The upgrade project used AERSCREEN version 16216 released 1/17/2017.

2.1 Source Parameters

The original Brookside Project consists of 15 individual fuel cells as depicted in Figure 2-1. Each individual fuel cell is approximately 25.5'L x 8.5'W x 6.75'H and utilizes approximately 1.32 MMBtu/hr of natural gas at full load to produce 200 kW of net power output. After the upgrade, the fuel cell will consume 1.24 MMBtu/hr of natural gas for the same output of 200kW.

As part of the chemical reaction within the fuel cell, NOx is formed and emitted at rate shown in the following table. **Note that after the upgrade, the total amount of NOx emitted from the site will have decreased by 19% measured in lb/MW-hr.**

NOx Emission Rates		
Original Project	0.0021 lb/MW-hr	0.0063 lb/hr site total
Upgrade Project	0.0017 lb/MW-hr	0.0044 lb/hr site total

Likewise CO is also formed as part of this chemical reaction and emitted at a rate shown in the following table. **Note that after the upgrade, the total amount of CO emitted from the site will have decreased by 66 % in lb/MW-hr.**

CO Emission Rates		
Original Project	0.10 lb/MW-hr	0.30 lb/hr site total
Upgrade Project	0.034 lb/MW-hr	0.09 lb/hr site total

AERSCREEN contains algorithms for modeling of several different types of emissions sources including volume sources. Volume source algorithms are valid for modeling releases from multiple vents and given the source characteristics of the fuel cell emissions, coupled with the fact that they are arranged in blocks, the fuel cells were modeled as volume type sources. Calculations for the upgrade project are also based on the Volume Source algorithm.

The AERSCREEN model is, by design, a conservative screening model and only allows the modeling of a single source for each run. In order to model the combined emissions from the concurrent operations

of all 15 fuel cells within AERSCREEN a single source was utilized and located at the center point of the southeastern fuel cell block.

Volume sources require the user to input an emission rate, release height, and both the initial lateral (sigma-y) and vertical (sigma-z) dimensions of the volume source. These last two parameters were calculated pursuant to the methodology detailed in Table 3-1 of the AERMOD Users Guide[2] and all volume source parameters utilized for AERSCREEN are summarized in Table 2-1. These values have been retained for the upgrade project.

2.2 AERSCREEN Inputs

In addition to the source parameters described in Section 2.2 AERSCREEN requires site specific information regarding land use and topography. AERSCREEN utilizes USGS Land Use/Land Classification (LULC) and USGS National Elevation Dataset (NED) for the required land use and topography information, respectively. Given the use of surface characteristics and terrain, it was important that the exact coordinate of the source, i.e., stack or center location of volume, be input into the model. Based upon the drawings provided by the Project it was determined that the approximate center of the facility is located at UTM coordinate 438667m, 4391163m based upon NAD83 projection, located within UTM Zone 18.

AERSCREEN requires the user to input a minimum and maximum receptor distance for impact prediction. The minimum receptor distance was set to the distance from the edge of the fuel cell block to the nearest physical fenceline. EPA considers all locations that the public is not precluded access to via a physical barrier as ambient air. As a result the physical fenceline and not the property line was used for the determination of the nearest modeling receptor which is consistent with current EPA guidance. The maximum modeling receptor distance was set to 2 km from the source. Figure 2-1 depicts the proposed facility fenceline in relation to the fuel cell locations.

AERSCREEN calculated the appropriate receptor elevations utilizing a 1 arc second resolution USGS NED file download from the USGS Seamless Server website (http://seamless.usgs.gov/). This NED file covered the area well beyond 2 km in all directions from the proposed facility location.

The meteorological data utilized by AERCREEN is inherently built into the model and represents a calculated range of site-specific conditions designed to determine a conservative worst-case impact. AERSCREEN provides three options for surface characteristics inputs for generating this screening meteorology.

One option allows for user-specified surface characteristics – albedo, Bowen ratio, and surface roughness (no spatial or temporal variation), the second option is to use seasonally varying surface characteristics for generic land use classifications. The third option is to input the name of an external file such as an AERSURFACE output file. Monthly, seasonal, and annual output for one sector or multiple sectors is allowed with the third option.

[2] Users Guide for the AMS/EPA Regulatory Model – AERMOD, EPA-454/B-03-001, September 2004.

For this analysis the third option of utilizing a site specific AERSURFACE file was chosen. AERSURFACE was run based on the following:

- UTM coordinate of 438667m, 4391163m (Zone 18, NAD 83)
- 1992 USGS Land Use Data
- 1 Sector
- 4 seasons with winter assumed to not have continuous snow cover
- 1 km radius for surface roughness, 10km domain for Bowen Ratio and Albedo

The original AERSURFACE file was also used for the upgrade project. Table 2-2 summarizes the surface parameters calculated by AERSURFACE for each season and subsequently was used as input to AERSCREEN for creating the site-specific screening meteorological data.

2.3 Background Data

In order to define the existing overall air quality setting for proper CO and NO_2 comparison with the NAAQS, monitored background concentrations from the EPA monitoring network are provided in Table 2-3. This table shows the monitored 98th-percentile 1-hour NO_2 levels as well as the maximum monitored 1-hour and 8-hour CO levels from the nearest EPA monitoring station for the most recent 3-year period available (2008 – 2010). The nearest EPA site for both pollutants is located at a distance of approximately 9.7 miles northeast of the project site.

Table 2-1
Parameters for Modeling Brookside Project within AERSCREEN

Volume Source Configuration

Parameter	Original Value	Upgrade Project Value	Notes
Source Height (ft)	6.75 ft	6.75 ft	Top of Fuel Cell
Initial Sigma-Z (ft)	3.14 ft	3.14 ft	Source height divided by 2.15
Source Length (ft)	51.0 ft	51.0 ft	
Source Width (ft)	8.5 ft	8.5 ft	
Source Area (ft^2)	433.5 ft^2	433.5 ft^2	
Volume Source Length (ft)	20.8 ft	20.8 ft	Assumes all sides equal
Initial Sigma-Y (ft)	4.8 ft	4.8 ft	Source length divided by 4.3
Distance to Fence (ft)	20ft	20ft	
NOx Emission Rate	0.0021 lb/MW-hr 0.0063 lb/hr (total)	0.0017 lb/MW-hr 0.0044 lb/hr (total)	Vendor Provided Data
CO Emission Rate	0.010 lb/MW-hr 0.30 lb/hr (total)	0.034 lb/MW-hr 0.09 lb/hr (total)	Vendor Provided Data

Table 2-2
AERSURFACE Parameters for Modeling Brookside Project
Original and Upgrade Project

Season	Albedo	Bowen Ratio	Surface Roughness (m)
Winter (Dec-Feb)	0.17	0.96	0.341
Spring (Mar-May)	0.16	0.69	0.407
Summer (Jun-Aug)	0.17	0.56	0.567
Autumn (Sep-Nov)	0.17	0.96	0.567

Notes:

- Winter season assumes after frost and no continuous snow cover
- Spring season assumes transitional spring (partial green coverage, short annuals)
- Summer season assumes mid-summer with lush vegetation
- Autumn season assumes unharvested cropland

Table 2-3
Background (in μg/m³) Concentrations For NAAQS Comparison (Wilmington, DE)
For the Original Project

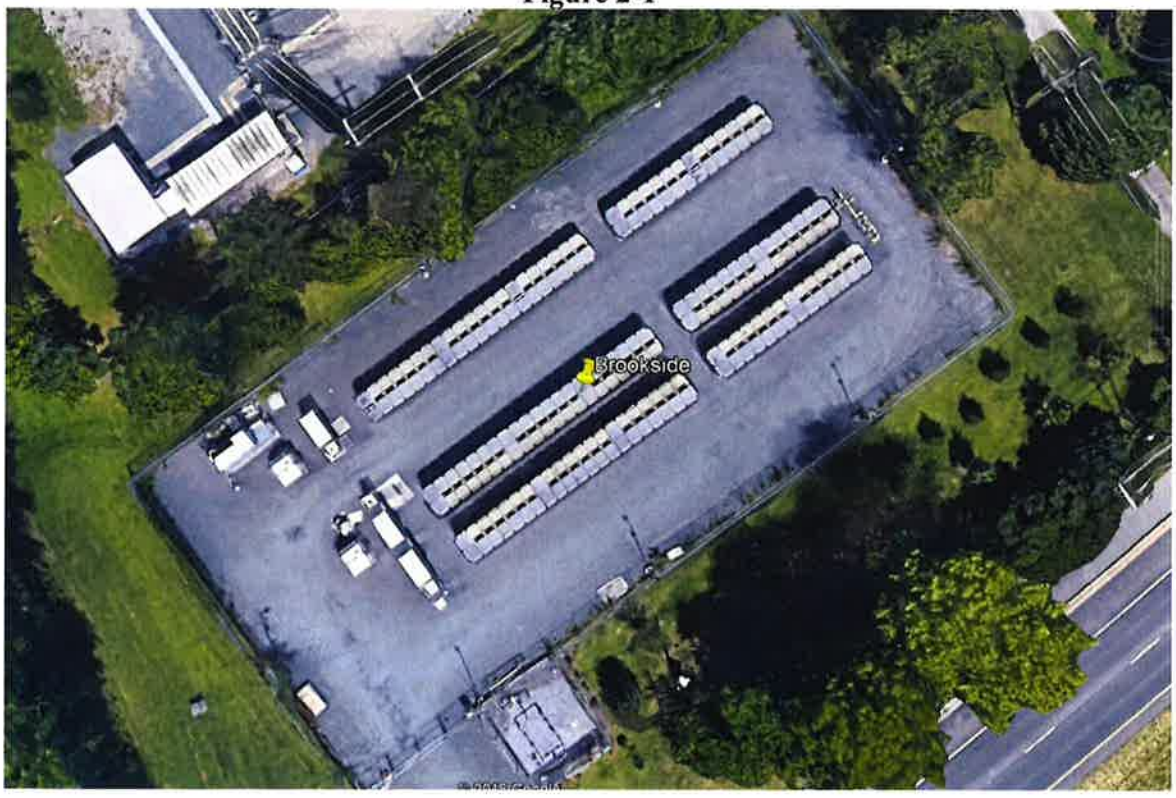
Pollutant	Averaging Period	Monitoring Station Location	Dist. (mi)	Dir. (deg)	2008	2009	2010	Ambient Standard
NO_2	1-Hour	MLK Blvd & Justison St	9.7	60	(127.8 + 101.5 + 94.0) / 3 = 107.8*			188[a]
CO	1-Hour	MLK Blvd & Justison St	9.7	60	2,400	3,200*	2,023	40,000
	8-Hour				1,444	1,556*	1,444	10,000

[a] Newly promulgated NAAQS one-hour NO_2 value is 100 ppb (188 μg/m³). The new NAAQS standard is statistical, based on the 3-year rolling average of the 98th-percentile of daily maximum 1-hour averages for each year.

* Indicates background value used in analysis.

Note: Direction indicated is from Brookside Project site to monitor.

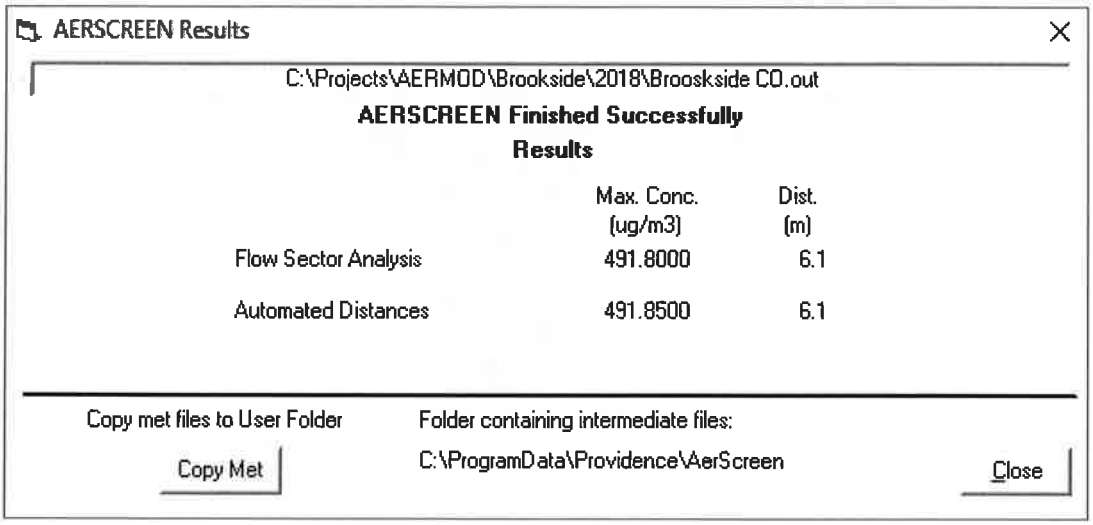
Figure 2-1

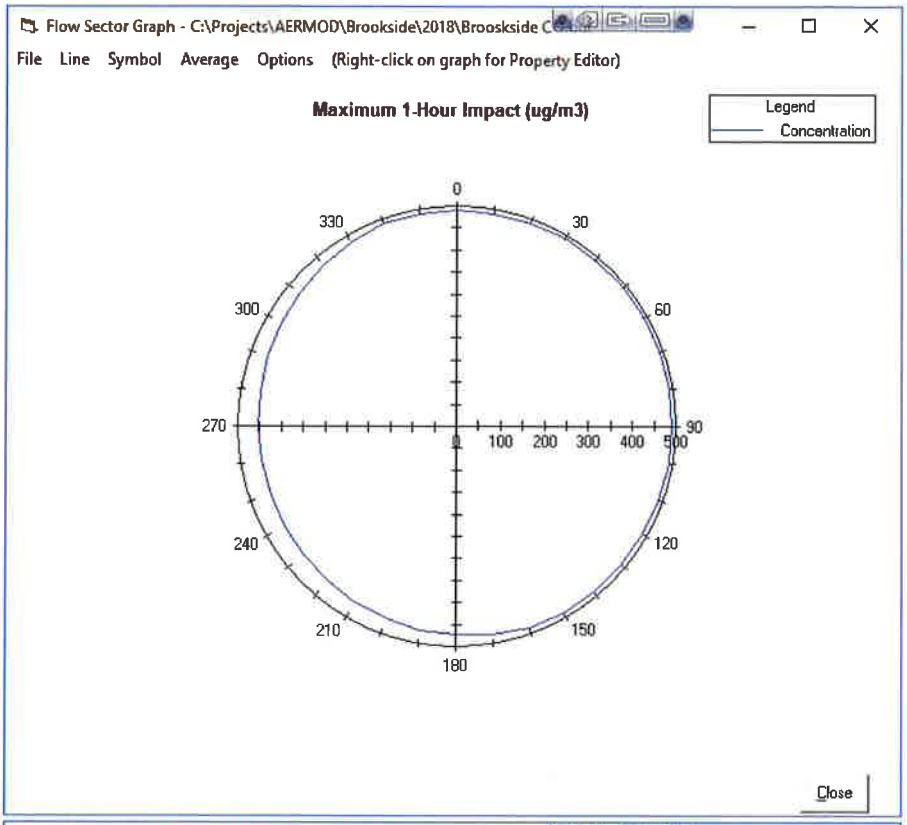


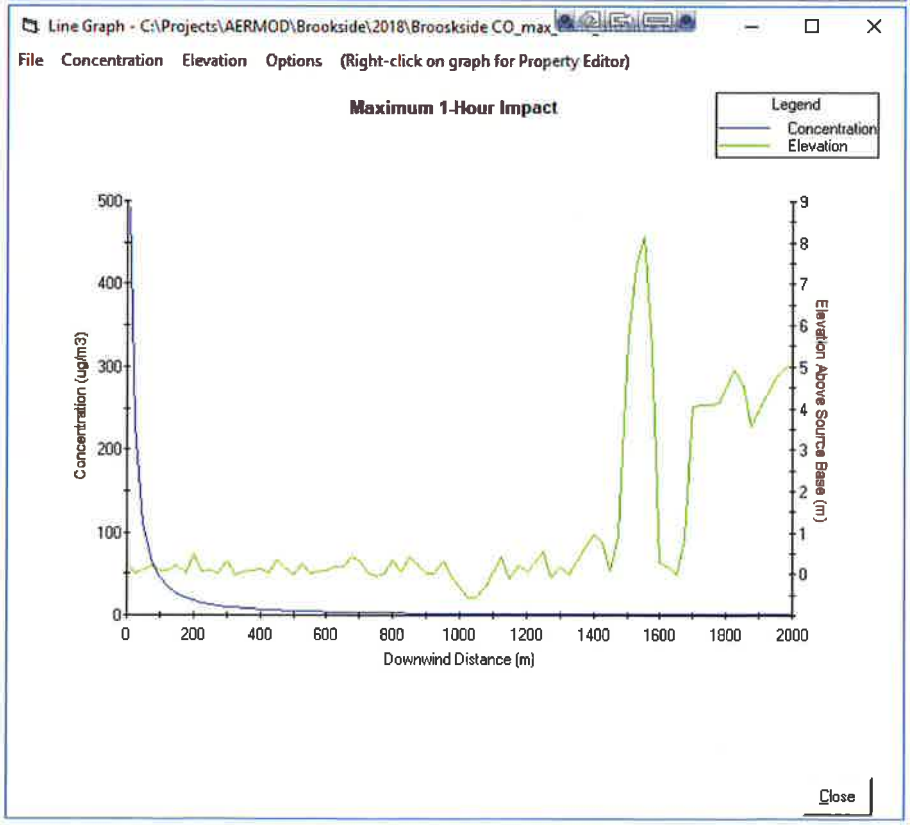
3.0 Modeling Results

The following sections present screenshots of the AERSCREEN modeling results for 1-hour NO_2, 1-hour CO and 8-hour CO for the Brookside Upgrade Project. All of the AERSCREEN modeling input and output files necessary to reproduce the upgrade project modeling results are included in the attached zip file.

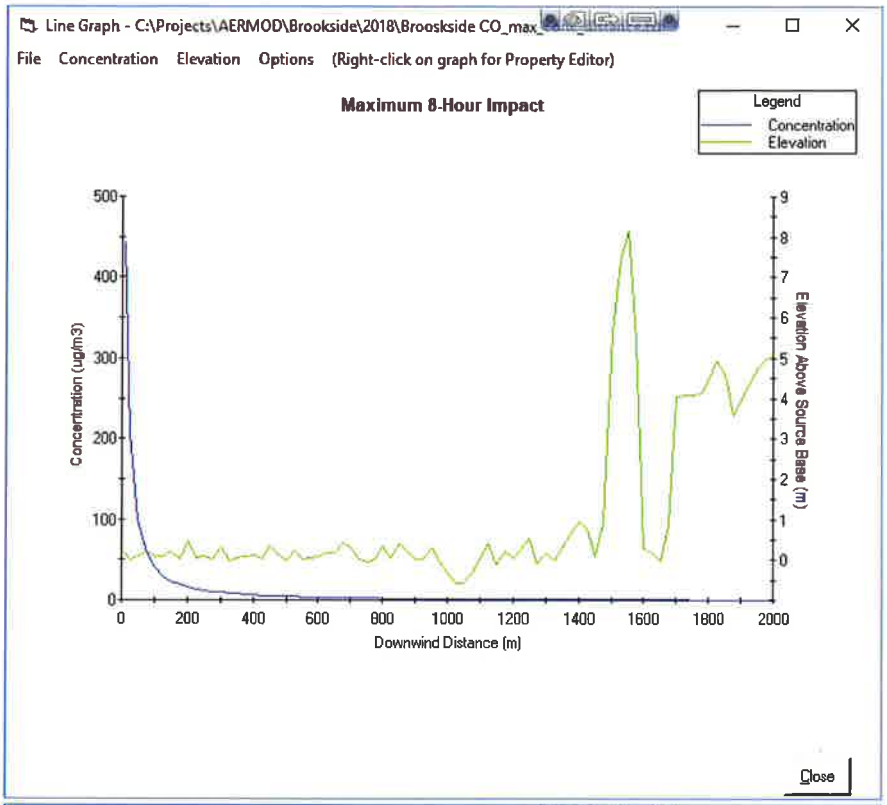
CO – 1 hour max

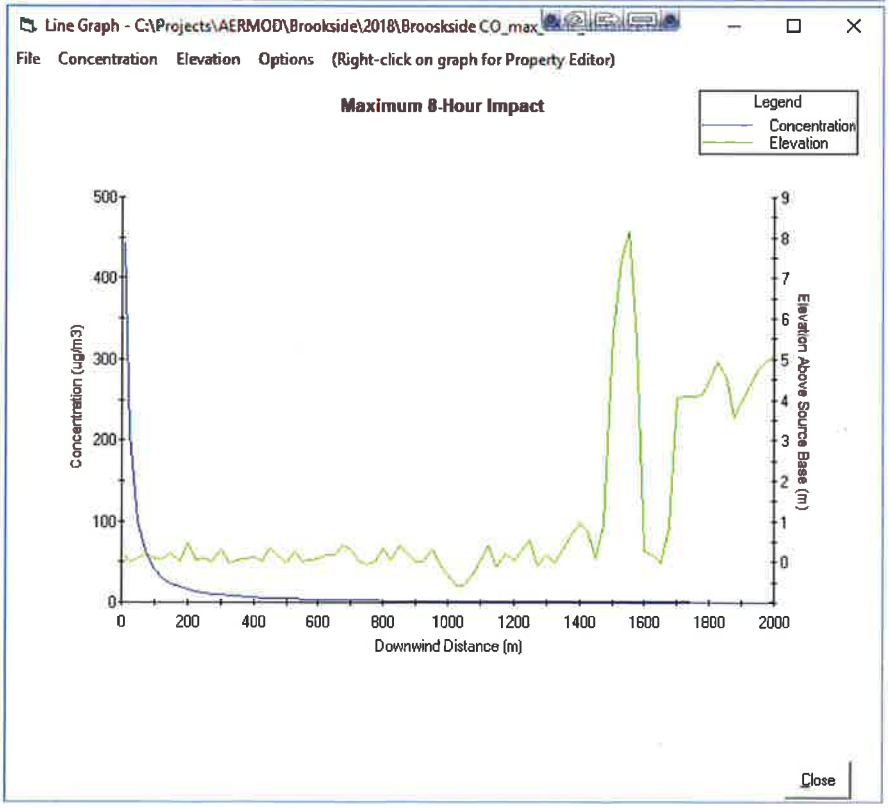



Flow Sector Graph - C:\Projects\AERMOD\Brookside\2018\Brookside C
File Line Symbol Average Options (Right-click on graph for Property Editor)
Maximum 1-Hour Impact (ug/m3)
Legend
Concentration
0
30
60
90
120
150
180
210
240
270
300
330
0
100
200
300
400
500
Close


Line Graph - C:\Projects\AERMOD\Brookside\2018\Brookside CO_max
File Concentration Elevation Options (Right-click on graph for Property Editor)
Maximum 1-Hour Impact
Legend
Concentration
Elevation
Concentration (ug/m3)
Elevation Above Source Base (m)
Downwind Distance (m)
0
100
200
300
400
500
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0
1
2
3
4
5
6
7
8
9
Close

CO – 8 hour max


Line Graph - C:\Projects\AERMOD\Brookside\2018\Brookside CO_max_
File Concentration Elevation Options (Right-click on graph for Property Editor)
Maximum 8-Hour Impact
Legend
Concentration
Elevation
Concentration (ug/m3)
Elevation Above Source Base (m)
Downwind Distance (m)
0 200 400 600 800 1000 1200 1400 1600 1800 2000
0 100 200 300 400 500
0 1 2 3 4 5 6 7 8 9
Close


Line Graph - C:\Projects\AERMOD\Brookside\2018\Brookside CO_max_
File Concentration Elevation Options (Right-click on graph for Property Editor)
Maximum 8-Hour Impact
Legend
Concentration
Elevation
Concentration (ug/m3)
Elevation Above Source Base (m)
Downwind Distance (m)
0 200 400 600 800 1000 1200 1400 1600 1800 2000
0 100 200 300 400 500
0 1 2 3 4 5 6 7 8 9
Close

NOx – 1 hour max

AERSCREEN Results

C:\Projects\AERMOD\Brookside\2018\Brookside 1-Hr NO2 Vol.out

AERSCREEN Finished Successfully

Results

	Max. Conc. (ug/m3)	Dist. (m)
Flow Sector Analysis	24.5900	6.1
Automated Distances	24.5880	6.1

Copy met files to User Folder

Copy Met

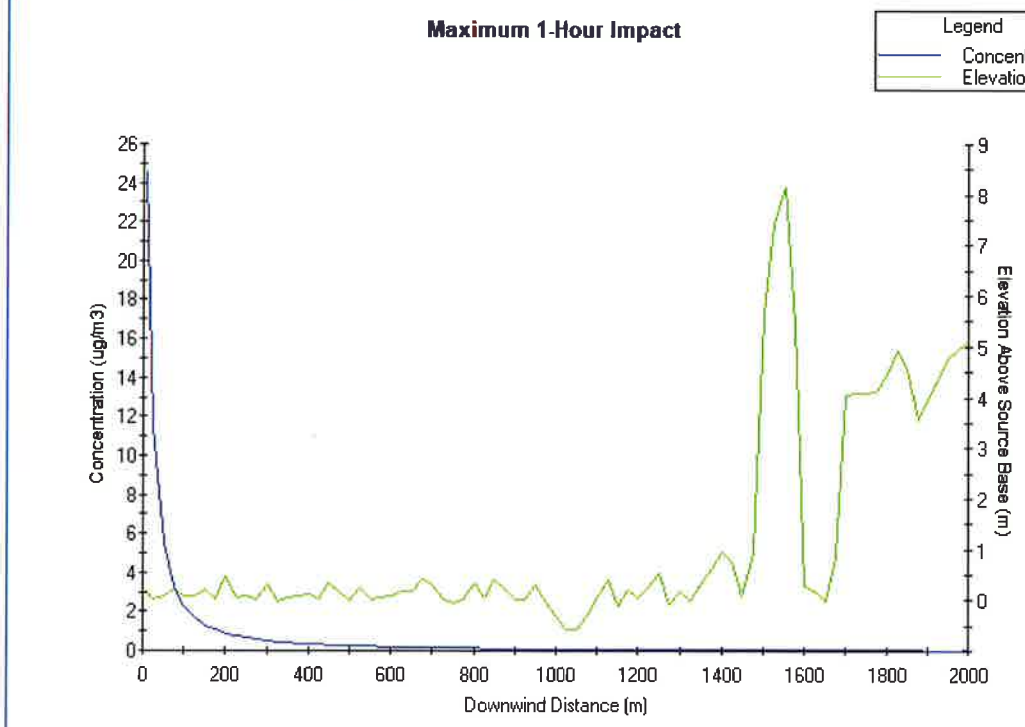
Folder containing intermediate files:

C:\ProgramData\Providence\AerScreen

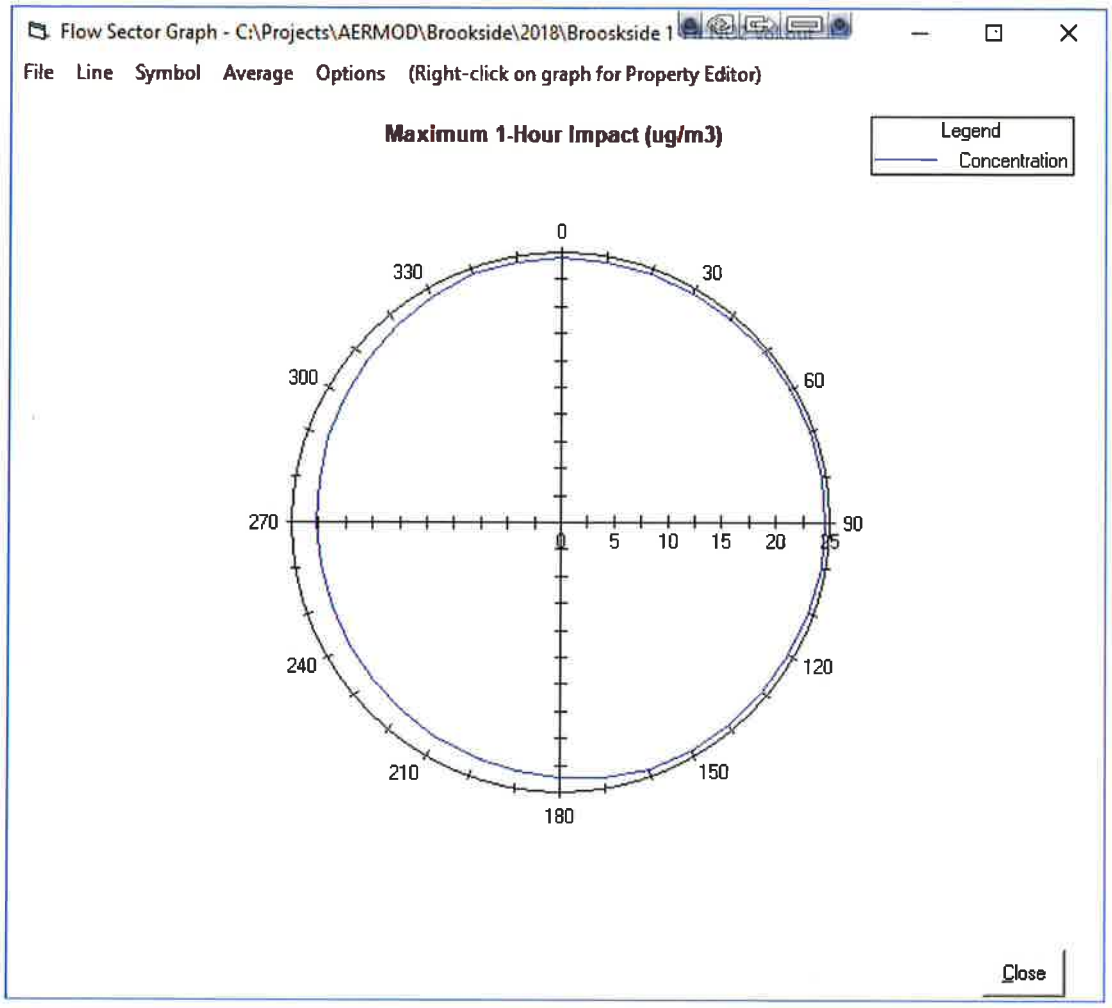
Close

Line Graph - C:\Projects\AERMOD\Brookside\2018\Brookside 1-Hr NO...

File Concentration Elevation Options (Right-click on graph for Property Editor)



Close


Flow Sector Graph - C:\Projects\AERMOD\Brookside\2018\Brookside 1
File Line Symbol Average Options (Right-click on graph for Property Editor)
Maximum 1-Hour Impact (ug/m3)
Legend
Concentration
0
30
60
90
120
150
180
210
240
270
300
330
0 5 10 15 20 25
Close